



## DEPARTMENT OF TRANSPORTATION

### Federal Aviation Administration

[Docket No.: FAA-2021-0710]

#### Noise Certification Standards: Matternet Model M2 Aircraft

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Final rule; rule of particular applicability.

**SUMMARY:** The Federal Aviation Administration (FAA) is promulgating noise certification standards that apply only to the Matternet Model M2 quadcopter unmanned aircraft (UA) because no generally applicable noise standards were available for this aircraft at the time the aircraft was presented for certification. Therefore, to complete the Matternet Model M2's type certification process for noise, the FAA adopts the standards in this rule for the Matternet Model M2.

**DATES:** This rule of particular applicability is effective [INSERT DATE OF FILING WITH THE FEDERAL REGISTER].

**ADDRESSES:** For information on where to obtain copies of rulemaking documents and other information related to this final rule, see "How To Obtain Additional Information" in the **SUPPLEMENTARY INFORMATION** section of this document.

**FOR FURTHER INFORMATION CONTACT:** For technical questions concerning this action, contact Hua (Bill) He, Federal Aviation Administration, Office of Environment and Energy, 800 Independence Ave. SW, Room 900 West, Washington, DC 20591; telephone (202) 267-3565; email [hua.he@faa.gov](mailto:hua.he@faa.gov).

#### SUPPLEMENTARY INFORMATION:

##### I. Authority for this Rulemaking

The FAA's authority to issue rules on aviation safety is found in Title 49 of the United States Code. Subtitle I, section 106 describes the authority of the FAA

Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the agency's authority.

This rulemaking is promulgated under the authority described in subtitle VII, part 447, and section 44715. Section 44715(a)(3) states that an original type certificate for an aircraft may be issued only after the Administrator of the FAA prescribes noise standards and regulations under that section that apply to the aircraft. This regulation is within the scope of that authority.

## **II. Good Cause**

The Administrative Procedure Act (5 U.S.C. 551 et seq.) requires the publication or service of any substantive rule not less than 30 days before its effective date, except as otherwise provided by the agency for good cause found and published with the rule. (5 U.S.C. § 553(d)). The FAA finds good cause exists to make this rule immediately effective because delaying the effective date is unnecessary. This rule applies to a single certification applicant (Matternet), and no other person will be affected by the requirements. FAA understands that Matternet likely is able to meet the standards when they become effective. The notice that would be provided by delaying the effective date is unnecessary. Moreover, delaying the effective date would negatively impact Matternet, the only party impacted by this rule, by delaying its ability to type certificate the Matternet Model M2, due to the lack of effective noise certification standards. Accordingly, the FAA finds that good cause exists to make this rule effective in less than 30 days.

## **III. Background**

### **A. Need for this Rulemaking**

Section 44704 of Title 49 of the United States Code requires that the FAA issue a type certificate to an applicant that presents a qualified design. Section 44715(a)(3)

requires the FAA to prescribe noise standards for an aircraft before a type certificate may be issued.

Matternet applied for type certification of its aircraft on May 18, 2018. The aircraft is a quadcopter design unmanned aircraft (UA) with a maximum takeoff weight of 29 pounds, including a 4-pound payload, and a proposed operating altitude of 400 feet or lower. To fulfill the statutory requirement of section 44715(a)(3), the FAA is adopting the set of noise certification standards described in this rule of particular applicability that will apply only to the Matternet Model M2, as the current noise certification standards cannot be applied effectively to this aircraft.

## **B. Related Actions**

This is the first rule of particular applicability establishing a noise certification basis for a single model of aircraft. At present, the FAA does not have a sufficient database of information about the noise generated by most UA models to establish generally applicable noise standards due to their novelty and variety. The FAA will continue to receive information about noise characteristics as it engages with certification applicants, and expects to use data collected through this rule to inform future rules of particular applicability and generally applicable standards. The FAA will consider similar rulemaking actions for other noise certification applicants while it develops the generally applicable standards for UA.

## **C. Summary of the NPRM**

On August 27, 2021, the FAA published a notice of proposed rulemaking (NPRM) setting out the noise certification test standards and noise limit that would apply to the Matternet Model M2 (86 FR 48281). The NPRM proposed that the requirements of 14 CFR 36.3 and 36.6 would apply to the Matternet Model M2 except as described in the rule, and proposed specific noise limits and testing procedures to be applied to the

Matternet Model M2 aircraft. The comment period for the NPRM closed September 27, 2021.

The NPRM was not intended to affect the airworthiness certification of this aircraft model or any operational approvals.<sup>1</sup> The FAA, in accordance with the applicable airworthiness standards and operating rules, makes those findings separately.

#### **IV. Discussion of Comments and Final Rule**

The FAA received submissions from 14 commenters. The commenters included five individuals, two engineering firms, four aircraft manufacturers and operators (Bell Textron, Inc., Zipline International, Inc., Ameriflight, LLC, and UPS Flight Forward, Inc.), and three aviation industry trade groups (Commercial Drone Alliance (CDA), Robotic Skies, and the Small UAV Coalition).

The aircraft manufacturers, aircraft operators, and aviation industry trade groups supported the proposed certification standards as being appropriate for the Matternet Model M2. Three individual commenters found the proposed noise limit unreasonable but presented no support for their comments or any alternatives. One individual expressed concern about UA noise impacts in general. As discussed in more detail in the following paragraphs, five commenters suggested specific changes in the noise measurement procedures for the Matternet Model M2. Three commenters suggested changes to noise test procedures that should apply to all UA rather than specifically to the Matternet Model M2.

One anonymous commenter suggested changes to the format of the proposed rule.

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<sup>1</sup> As is true for all noise certification, this rule neither assesses the environmental impacts of any eventual operation of the subject aircraft, nor constitutes any environmental review that may be required by the FAA before granting operational approval. Any such environmental review would be completed in advance of granting operational approval(s).

## **A. Comments Regarding the Proposed Noise Certification Standards for the Matternet Model M2**

### **1. Noise limit objections**

Three commenters expressed dissatisfaction regarding the 78 dBA noise limit specified for the Matternet Model M2. These commenters described other noise metrics with lower values, but the metrics suggested were not relevant to the certification of an individual aircraft. In one case, the commenter appeared to reference the sound level applied for compatible land use planning around airports, however, the sound level referenced would not be applicable to an individual aircraft model. This sound level, known as day-night average sound level (DNL) 65 dB, is an average of all flights over a certain area. Although the FAA uses DNL 65 dB as the significance threshold when it performs environmental planning reviews, DNL 65 dB is not the appropriate threshold here because it applies to the average noise of all aircraft in a particular area, as opposed to a single aircraft, the Matternet Model M2. Another commenter suggested a limit of 30 dB, but did not provide justification for the suggestion, or indicate how the limit should be used. The FAA makes no change to the proposed noise limit for the Matternet Model M2 in this final rule.

### **2. Noise limit clarification**

One individual commenter expressed concern with the FAA's explanation of the 78 dB noise limit. The FAA clarifies below the approach in setting the limit at 78dB, as the intent is to maintain a consistent noise certification approach that includes aircraft of all sizes, including UA.

In the absence of historical data regarding most models of UA, the FAA began its analysis by using the existing noise limits in the regulations and extrapolating those limits to a lower-weight aircraft tested at a lower altitude. The FAA used established limit data from the appendices (including A and J) to part 36 where practicable, and FAA applied

accepted, well-known noise certification principles and adjustment methods in developing this rule. Since the Matternet Model M2 is a quadcopter, the FAA used as its starting point the simplified helicopter noise limit found in part 36 appendix J that applies to smaller helicopters (§ J36.305 (a)(2)). One key assumption of this method is that fundamental rotorcraft physics and associated noise are scalable for lighter-weight UA. For the subject aircraft, the Stage 3 noise limit of appendix J was extrapolated to the maximum takeoff weight (MTOW) to correspond to a 527-pound aircraft. A secondary noise adjustment was applied to account for the adjusted reference altitude of 250 feet for the Matternet Model M2, rather than the 492-foot reference altitude in appendix J. These two adjustments account for the size and the expected operational altitudes of the Matternet Model M2. These adjustments provide the basis for the constant 78 dB limit for the Matternet Model M2. No change was made to this final rule based on this comment.

3. Noise measurement procedure – atmospheric attenuation limit in paragraph (9)(b)

Acoustical Analysis Associates, Inc. stated that the atmospheric absorption limitation of 10 dB per 100 meters at 8 kHz in paragraph (9)(b) is unnecessarily restrictive, because sound propagation paths during the noise test of UA will be shorter than they are for light helicopters tested under appendix J. The commenter suggested that the limit be relaxed to allow atmospheric absorption up to 12dB per 100 meters. Although the FAA proposed the atmospheric absorption limit from appendix J without change, the agency considers the recommended change reasonable as a less stringent and more flexible approach when considering the test environment for UA. Therefore, in this final rule, the FAA has revised paragraph (9)(b) to reflect an atmospheric absorption limitation of 12dB per 100meters.

#### 4. Supplemental noise test

The Small UAV Coalition stated that any “voluntary” test, in this case the voluntary hover test Matternet agreed to conduct, should not be an element in setting a noise certification basis, and that data from a voluntary test “should not be an element in setting a noise certification basis.”<sup>2</sup>

The FAA reiterates that the data collected during the voluntary hover tests will not be used to inform the applicant’s airworthiness or type certification basis, or be evaluated against any noise limits or regulatory criteria for noise certification purposes. This supplemental test is designed to gather further information on an aircraft that is capable of hovering. This approach will enable the FAA to create a larger database of UA reference noise data. The FAA is seeking the data so that the agency can understand and more accurately describe relevant factors of UA noise generation, and to use them to inform future rules of general applicability for UA. Finally, as described in the NPRM preamble, Matternet has agreed to conduct another test and give the resulting data to the FAA to inform the larger database of noise experience with UA. No change was made to this final rule based on this comment.

#### 5. Technological practicability and economic reasonableness

The Small UAV Coalition expressed general concern that the test procedures proposed for the Matternet Model M2 were unnecessarily complex, making them costly and “economically unreasonable” for many smaller UA manufacturers. Zipline International, Inc. expressed a similar concern. Neither Small UAV Coalition nor Zipline International, Inc. presented any information regarding how the proposed test requirements could be made less complex or less economically burdensome and still meet the requirements for certifying a new aircraft model.

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<sup>2</sup> See Small UAV Coalition comment at p. 2.

The FAA agrees with comments that the testing requirements should be the simplest, most appropriate means of meeting noise requirements. The FAA's statutory authority requires that the agency consider whether proposed standards are "economically reasonable, technologically practicable, and appropriate for the applicable aircraft." See 49 U.S.C. 44715(b)(4). Thus, in formulating the standards for the Matternet Model M2, the FAA started with the simplest and most appropriate means of noise certification testing established in existing regulation (14 CFR part 36, appendix J), and, as described above, extrapolated down to values appropriate for a much smaller aircraft. The FAA then developed test procedures intended to function more closely to the anticipated operating envelope for the Matternet Model M2.

As previously noted, commenters did not present any suggestions for how the proposed test procedures could be made less complex or less economically burdensome and still meet noise certification requirements. Further, these comments express concern regarding standards for future certification projects rather than the Matternet Model M2 standards. Accordingly, no change is made to this final rule based on these comments.

## **B. Comments Regarding Noise Certification for Unmanned Aircraft: General**

### **1. Elimination of <J3> duration adjustment**

Acoustical Analysis Associates Inc. suggested eliminating the <J3> duration adjustment, contained in the data correction procedure (paragraph (27)(c)). The correction procedure compensates for off-reference ambient temperature conditions (also referred to as tip Mach airspeed correction) because this adjustment, originally developed for lighter weighted helicopters in part 36 appendix J, is not well suited to UA designs.

The FAA will consider this suggestion in developing future generally applicable UA noise certification standards as more certification data is collected and the agency's understanding of UA noise propagation is improved. At this time, the FAA concludes that there is insufficient data to justify making the change suggested by the commenter.



## 2. Use of ground microphone

An anonymous commenter and Josephson Engineering suggested either the use of a ground microphone on a hard surface, or the use of an inverted microphone placed on a ground board, as used in appendix G to part 36 (applicable to small airplanes) procedures for noise certification measurement. The proposed standards for the Matternet Model M2 proposed placing the microphone on a tripod or pole at 4 feet above the ground for UA noise certification measurements. The commenter stated that a ground microphone placement would help to reduce measurement uncertainty inherent in the 4-foot microphone placement.

Although the FAA understands the commenter's concerns, a pole-placed microphone is relatively simple and less costly to deploy in noise certification measurement when compared to a ground-plane microphone. In order to develop a testing method more widely applicable to UA noise certification, the FAA will continue to compile data and research results to inform future generally applicable rulemaking for testing procedures for UA noise certification. The FAA may make further changes to these procedures as the research matures. No change was made to this final rule based on this comment.

## 3. Use of multiple microphones for hover noise measurement

Bell Textron, Inc. suggested the use of multiple microphones for hover noise testing to reduce testing time and improve efficiency. The FAA identified such hover test requirements in paragraph (16) of the proposed and final rule as supplemental hover test conditions. The proposed rule was designed to be simpler for UA by using fewer microphones, decreasing the cost and workload associated with using more. If any applicant finds that the use of more microphones has an advantage, the FAA would review and approve their use. No change is made to this final rule based on the comment.

#### 4. Noise limit varying with UA weight

Bell Textron, Inc. commented on the noise limit generally, not specifying a noise limit change specific to the Matternet Model M2. The commenter recommended that the FAA develop a noise limit that would change with the maximum takeoff weight (MTOW) for higher-weight UA. The FAA acknowledges that a noise limit corresponding with weight is a recognized standard convention applied to other aircraft in part 36 and by Annex 16 to the Convention on International Civil Aviation, Environmental Protection, Volume I, Aircraft Noise. As the commenter did not offer any rationale, supporting information, or data for the FAA to consider with regard to UA noise certification for UA at different weights, or the Matternet Model M2's specific weight, the FAA retains the proposed constant 78 dB SEL noise limit for the Matternet Model M2 in this final rule. Until more noise data become available for UA at specific weights, the FAA will continue to extrapolate noise limits on a case-by-case basis.

#### **C. Rule structure**

An anonymous commenter suggested that the FAA revise the proposed rule structure (paragraph numbers 1 to 33) to a shorter and simpler section numbering approach to help the reader, citing appendix J to part 36 as an appropriate example. In choosing a format, the FAA considered the UA applicant's relative inexperience with noise testing. Because the regulations in appendix J are complex, the FAA chose an approach that would allow all noise testing requirements to be contained in a single source. The FAA will consider alternative formatting as experience with the noise certification of UA continues. No change was made to this final rule based on this comment.

#### **D. Corrections for the final rule**

The FAA identified errors in referencing paragraph numbers in the proposed regulatory text. The following table identifies the paragraphs where the errors occurred and the corrections made in the final rule:

<b>Referenced in Paragraph:</b>	<b>NPRM language</b>	<b>Final Rule language</b>
(2)	paragraphs (7) through (23)	paragraphs (7) through (22)
(3)	paragraphs (7) through (23)	paragraphs (7) through (24)
(3)(b)	paragraphs (24) through (26)	paragraphs (25) through (27)
(10)(a)	paragraph (17)	paragraph (18)
(10)(b)	paragraph (26)	paragraph (27)
(15)	paragraphs (17) through (21)	paragraphs (17) through (22)
(16)	(a) through (f)	(a) through (g)
(28)	paragraphs (7) through (26)	paragraphs (7) through (27)

In addition, citations in the proposed rule to § 36.6 are not included in this final rule. Section 36.6 contains descriptions of material that has been incorporated by reference (IBR) in part 36. The IBR process is necessary only for rules of general applicability; it, therefore, has no function in this rule. Material referenced in the text of this rule is accepted by the applicant when it uses such material as its means of compliance at the time of certification.

Except for the aforementioned change to paragraph (9)(b), the corrections to certain cross-references in the proposed regulatory text, and the removal of the reference to § 36.6, the NPRM is adopted as proposed.

## **V. Regulatory Notices and Analyses**

### **A. Regulatory Evaluation**

This rule of particular applicability is not subject to review under Executive Order 12866, Regulatory Planning and Review, as that Executive Order applies only to rules of general applicability.

### **B. Regulatory Flexibility Determination**

The Regulatory Flexibility Act of 1980 (Pub. L. 96-354) (RFA) establishes “as a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the businesses, organizations, and governmental jurisdictions subject to regulation.” To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration. The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a rule will have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA. However, if an agency determines that a rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify, and a regulatory flexibility analysis is not required.

This rule only impacts Matternet, which is considered a small business based on the U.S. Small Business Administration (SBA) size standards. The SBA lists small business size standards based on the North American Industry Classification System (NAICS). NAICS code 336411 is titled “Miscellaneous Aircraft Manufacturing,” and

includes the manufacture of unmanned and robotic aircraft. The SBA defines industries within this code to be small if they employ 1,500 employees or less.

The FAA expects that under this rule of particular applicability Matternet will incur small costs to conduct noise testing and gather data but will benefit Matternet by enabling a noise certification basis for it to complete the type certification it seeks. The FAA expects this rule will not have a significant economic impact on Matternet.

If an agency determines that a rulemaking will not result in a significant economic impact on a substantial number of small entities, the head of the agency may so certify under section 605(b) of the RFA. Therefore, based on the foregoing discussion, as provided in section 605(b), the head of the FAA certifies that this rulemaking will not result in a significant economic impact on a substantial number of small entities.

### **C. International Trade Impact Assessment**

The Trade Agreements Act of 1979 (Pub. L. 96-39), as amended by the Uruguay Round Agreements Act (Pub. L. 103-465), prohibits Federal agencies from establishing standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Pursuant to these Acts, the establishment of standards is not considered an unnecessary obstacle to the foreign commerce of the United States, so long as the standard has a legitimate domestic objective, such as the protection of safety, and does not operate in a manner that excludes imports that meet this objective. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. The FAA has determined this rule would not present any obstacle to foreign commerce of the United States. In addition, this rule is not contrary to international standards since no international standards for UA noise certification exist.

#### **D. Unfunded Mandates Assessment**

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104-4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of \$100 million or more (in 1995 dollars) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a “significant regulatory action.” The FAA currently uses an inflation-adjusted value of \$155 million in lieu of \$100 million. This rule does not contain such a mandate; therefore, the requirements of Title II of the Act do not apply.

#### **E. Paperwork Reduction Act**

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. The FAA has determined that there is no new requirement for information collection associated with this rule of particular applicability.

#### **F. International Compatibility**

The FAA remains actively involved in the International Civil Aviation Organization’s (ICAO) Committee on Aviation Environmental Protection (CAEP) and CAEP’s Working Group 1 that addresses aircraft noise. Working Group 1 began activities to address noise from UA in 2013. There are, at present, no noise or other environmental standards for UA that have been adopted into ICAO Annex 16. The FAA has determined that there are no ICAO Standards and Recommended Practices that correspond to the rule so as to require conformance.

While the FAA has begun type and noise certification of UA, the European Union Aviation Safety Agency (EASA) has focused on operational regulations. In March 2020, EASA published its Easy Access Rules for Unmanned Aircraft (Regulation 2019/947 and delegated regulation 2019/945), which contain the applicable rules and procedures for the

operation of UA in the EU. While the regulations contain some requirements for noise measurement depending on the operating environment of the UA, they are limited to operations in the EU and are not a certification standard as established by this rule.

## **G. Environmental Analysis**

FAA Order 1050.1F identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The FAA has determined this rulemaking action qualifies for the categorical exclusion identified in paragraph 5-6.6 (d) (Categorical Exclusions for Regulatory Actions) for regulations since it is a rulemaking action that proscribes a certification test standard, and would not presume the acceptability of operation of any particular aircraft in any location. No extraordinary circumstances are involved.

## **VI. Executive Order Determinations**

### **A. Executive Order 13132, Federalism**

The FAA has analyzed this final rule under the principles and criteria of Executive Order 13132, Federalism. The agency determined that this action will not have a substantial direct effect on the States, or the relationship between the Federal Government and the States, or on the distribution of power and responsibilities among the various levels of government, and, therefore, does not have Federalism implications.

### **B. Executive Order 13211, Regulations that Significantly Affect Energy Supply, Distribution, or Use**

The FAA analyzed this final rule under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). The agency has determined that it is not a “significant energy action” under the executive order and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

## **VII. How to Obtain Additional Information**

### **A. Rulemaking Documents**

An electronic copy of a rulemaking document may be obtained by using the Internet—

1. Search the Federal eRulemaking Portal at [www.regulations.gov](http://www.regulations.gov);
2. Visit the FAA's Regulations and Policies Web page at [www.faa.gov/regulations\\_policies](http://www.faa.gov/regulations_policies); or
3. Access the Government Printing Office's Web page at [www.GovInfo.gov](http://www.GovInfo.gov).

Copies may also be obtained by sending a request (identified by notice, amendment, or docket number of this rulemaking) to the Federal Aviation Administration, Office of Rulemaking, ARM-1, 800 Independence Avenue SW, Washington, DC 20591, or by calling (202) 267-9677.

### **B. Comments Submitted to the Docket**

Comments received may be viewed by going to <https://www.regulations.gov> and following the online instructions to search the docket number for this action. Anyone is able to search the electronic form of all comments received into any of the FAA's dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.).

### **The Noise Certification Basis**

In consideration of the foregoing, and under the authority of Title 49 of the United States Code, section 44715(a), the Federal Aviation Administration (FAA) establishes the following standards and procedures as the noise certification basis of the Matternet Model M2 unmanned aircraft (UA).

All statutory references in this Rule of Particular Applicability (rule) refer to Title 49 of the United States Code. All regulatory references refer to Title 14 of the Code of Federal Regulations, part 21 or part 36 and its appendices, unless otherwise cited.



## **Noise Certification Requirements for the Matternet Model M2:**

(1) **General:** The requirements and limitations of 14 CFR 36.3 apply to the Matternet Model M2, except as described herein.

(a) **Limitations** (Reference § 36.5, as modified): Pursuant to 49 U.S.C. 44715(b)(4), the noise level in this Rule of Particular Applicability (rule) has been determined to be as low as is economically reasonable, technologically practicable, and appropriate for this aircraft. No determination is made that these noise levels are or should be acceptable or unacceptable for operation at, into, or out of, any airport, landing or launch pad, community, or any other environment that may be impacted or is sensitive to noise.

(b) **Acoustical Change** (Reference § 36.9 as modified): If, after type certification using the requirements stated herein, the aircraft incorporates a change in type design, the changed design is subject to an acoustical change analysis and approval in accordance with § 21.93(b). After such change in design, the aircraft may not subsequently exceed the noise limits specified in this rule.

(2) **Noise Measurement** (Reference § 36.801, as modified): The noise generated by the aircraft must be measured at the noise measuring point and under the test conditions prescribed in paragraphs (7) through (23) of this rule, or using an equivalent procedure approved by the FAA before testing. Any procedure not approved by the FAA before a test is performed is subject to disapproval and may require the aircraft to be retested using an approved procedure.

(3) **Noise Evaluation** (Reference § 36.803, as modified): The noise measurement data required by paragraph (2) of this rule must be obtained using the test procedures in paragraphs (7) through (24) of this rule, and:

(a) Corrected to the reference conditions contained in paragraphs (5) and (6) of this rule; and

(b) Evaluated using the procedures in paragraphs (25) through (27) of this rule, or using an FAA-approved equivalent procedure. Any procedure not approved by the FAA before a test is performed is subject to disapproval and may require the aircraft to be retested using an approved procedure.

**(4) Noise Limits** (Reference § 36.805, as modified): Compliance with the noise limits prescribed in paragraphs (28) and (29) of this rule must be shown for this aircraft for which application for issuance of a type certificate in the special class is made under part 21.

**(5) Reference Conditions - General** (Reference part 36 appendix J, section J36.1, as modified): Paragraphs (6) through (29) of this rule prescribe the noise certification requirements for this aircraft, including:

(a) The conditions under which each noise certification test must be conducted and the measurement procedure that must be used to measure the aircraft noise during the test;

(b) The procedures that must be used to correct the measured data to the reference conditions, and to calculate the noise evaluation quantity designated as the

A-weighted Sound Exposure Level (SEL, denoted by symbol  $L_{AE}$ ); and

(c) The noise limit with which compliance must be shown.

**(6) Reference Conditions – Test** (Reference part 36 appendix J, section J36.3, as modified):

(a) Meteorological Conditions - The following are the noise certification reference atmospheric conditions that are assumed to exist from the surface to the aircraft altitude:

i. Sea level pressure of 2,116 pounds per square foot (76 centimeters of mercury);

ii. Ambient temperature of 77 degrees Fahrenheit (25 degrees Celsius);

iii. Relative humidity of 70 percent; and

iv. Zero wind.

(b) Reference test site. The reference test site is flat and without line-of-sight obstructions, including any area across the flight path that is long enough to encompass the 10 dB down points of the A-weighted time history.

(c) Level flyover reference profile. For UA, the reference flyover profile is a level flight, 250 feet (76.2 meters) above ground level as measured at the noise measuring station. The reference flyover profile has a linear flight track and passes directly over the noise monitoring station. The applicable reference airspeed is stabilized and maintained throughout the measured portion of the flyover. Rotor speed is normal operating RPM throughout the 10 dB-down time interval. For UA, applicable reference airspeeds are:

i.  $V_{\max} \sim 0.9V_{NE}$ , where  $V_{NE}$  is the never-exceed airspeed (at empty weight).

ii.  $V_{\text{cruise}} \sim V_H$ , where  $V_H$  is the maximum performance airspeed (at maximum certificated takeoff weight (MTOW)),

(d) Two series of flyover tests are required. Each series must be flown at the weight and applicable reference speed conditions as follows:

i. MTOW (inclusive of payload) and  $V_{\text{cruise}}$ ; and

ii. Empty weight (no payload) and  $V_{\max}$ .

**(7) Noise Measurement Procedures -- General** (Reference part 36, appendix J, section J36.101(a) as modified): Paragraphs (8) through (10) of this rule prescribe the conditions under which the aircraft noise certification tests must be conducted, and the measurement procedures that must be used to measure the aircraft noise during each test.

**(8) Test site requirements** (Reference: part 36, appendix J, section J36.101(b), as modified):

(a) The noise measuring station must be surrounded by terrain having no excessive sound absorption characteristics, such as might be caused by thick, matted, or

tall grass, shrubs, wooded areas, or loose soil. Grass is acceptable if mowed to 3 inches or less in a 25-foot radius around any sound measuring stations.

(b) During the period when the flyover noise measurement is within 10 dB of the maximum A-weighted sound level, no obstruction that significantly influences the sound field from the aircraft may exist within a conical space above the noise measuring position (the point on the ground vertically below the microphone). The cone is defined by an axis normal to the ground and by half-angle 80 degrees from this axis.

**(9) Weather restrictions** (Reference: part 36, appendix J, section J36.101(c) as modified): Each test must be conducted under the following atmospheric conditions:

(a) No rain or other precipitation.

(b) Ambient air temperature between 36 degrees and 95 degrees Fahrenheit (2 degrees and 35 degrees Celsius), inclusively, and relative humidity between 20 percent and 95 percent inclusively, except that testing may not take place where combinations of temperature and relative humidity result in a rate of atmospheric attenuation greater than 12 dB per 100 meters (36.6 dB per 1,000 feet) in the one-third octave band centered at 8 kiloHertz.

(c) Wind velocity that does not exceed 10 knots (19 km/h) and a crosswind component that does not exceed 5 knots (9 km/h). The wind must be determined using a continuous averaging process of no greater than 30 seconds.

(d) Measurements of ambient temperature, relative humidity, wind speed, and wind direction must be made between 4 feet (1.2 meters) and 33 feet (10 meters) above the ground. Unless otherwise approved by the FAA, ambient temperature and relative humidity must be measured at the same height above the ground.

(e) No anomalous wind conditions (including turbulence) or other anomalous meteorological conditions that could significantly affect the noise level of the aircraft when the noise is recorded at the noise measuring station.

(f) If the measurement site is within 6,560 feet (2,000 meters) of a fixed meteorological station (such as those found at airports or other facilities), the weather measurements reported at that station may be used for temperature, relative humidity and wind velocity, when approved by the FAA before the test is conducted. The use of measurements reported at a fixed meteorological station, if not approved by the FAA before a test is performed, may cause the test to be disapproved and require that the aircraft be retested.

**(10) Aircraft test procedures** (Reference part 36, appendix J, section J36.101(d), as modified):

(a) The aircraft test procedures and noise measurements must be conducted and processed in a manner that yields the noise evaluation measure designated  $L_{AE}$ , as defined in paragraph (18) of this rule.

(b) The aircraft height relative to the noise measurement point sufficient to make corrections required in paragraph (27) of this rule must be determined by an FAA-approved method that is independent of normal flight instrumentation, such as a Differential Global Positioning System (DGPS), or photographic scaling techniques. The aircraft position in three dimensions relative to the microphone must be monitored and recorded at all times during the test and data collection, with correlation via time synchronization to the acoustic noise data collection. The accuracy of the aircraft location system, and all sources of inaccuracy, along with possible error introduction when correlating to measured and recorded noise (inaccuracies of timing devices and methods), must be determined and reported. A description of the aircraft location system and its accuracy must be included as part of the noise test plan required by paragraph (31) of this rule, and approved by the FAA before use.

(c) If an applicant demonstrates that the design characteristics of the aircraft would prevent flight from being conducted in accordance with the reference test

conditions prescribed in paragraph (6) of this rule, then the applicant may request a variance in reference test conditions to be used. Any variance from standard reference test conditions is limited to that required for the subject aircraft design characteristics that make compliance with the reference test conditions impossible.

**(11) Flyover Test Conditions** (Reference part 36, appendix J, section J36.105(a), as modified): Paragraphs (12) through (15) of this rule prescribe the flight test conditions and allowable random deviations for flyover noise tests conducted to demonstrate compliance with this rule.

**(12) Level flight height and lateral path tolerances** (Reference part 36, appendix J, section J36.105(b), as modified): A test series must consist of at least six flights. The number of level flights made with a headwind component must be equal to the number of level flights made with a tailwind component over the noise measurement station:

- (a) In level flight and in cruise configuration;
- (b) At the test height above the ground level over the noise measuring station as defined in paragraph (6) of this rule. For the selected height, the vertical tolerance of this height should be  $\pm 10\%$  value; and
- (c) Within  $\pm 10$  degrees from the zenith.

**(13) Airspeed and Controls** (Reference part 36, appendix J, section J36.105(c), as modified): Each flyover noise test flight must be conducted:

- (a) At the reference airspeed specified in paragraph (6)(c) of this rule; and
- (b) With the flight controls stabilized during the period when the measured aircraft noise level is within 10 dB of the maximum A-weighted sound level ( $L_{Amax}$ ).

**(14) Aircraft weight** (Reference part 36, appendix J, section J36.105(d), as modified): For the weight at which noise certification is requested, the aircraft test weight for each flyover test series must be specified for:

(a) MTOW (inclusive of payload); and

(b) Empty weight (no payload).

**(15) Flyover height adjustment** (Reference part 36, appendix J, section J36.105(e), as modified): If ambient noise at the measurement station, measured in accordance with paragraphs (17) through (22) of this rule, is found to be within 15 A-weighted decibels (dB(A)) of the A-weighted aircraft noise level ( $L_{Amax}$ ), measured at the same location, the applicant may request the FAA approve an alternate flyover height. If an alternate flyover height is approved, the results must be adjusted to the reference flyover height specified in paragraph (6)(c) of this rule using an FAA-approved method.

**(16) Supplemental hover test conditions** –This is a supplemental test to collect data for assessment of community noise impacts, and to inform later general noise and test standards for UA. This supplemental test does not require compliance with a noise limit and does not affect the noise certification findings for the subject aircraft.

The aircraft is required to hover at different spatial locations relative to the microphone in accordance with subparagraphs (a) through (g) of this paragraph.

(a) The aircraft must be at MTOW, inclusive of maximum payload weight of cargo.

(b) To ensure that the widest dimensional profile of the noise source is captured in the recordings, for each aircraft attitude heading (0, 90, 180 and 270 degrees) relative to the microphone position for hover conditions described in paragraphs (16)(c) and (d) of this rule, stabilize the aircraft in hover and record the sound in accordance with paragraph (16)(f) of this rule.

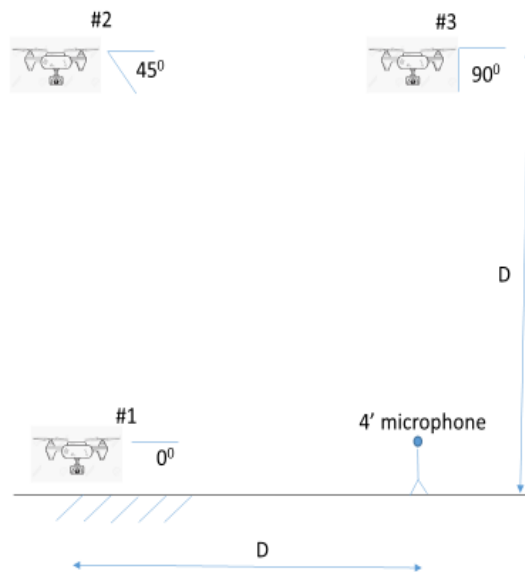
(c) Hover condition #1 (sound elevation angle at zero degrees): The aircraft maintains a hover condition at a lateral distance of 20 feet to the microphone and at 4 feet above ground level (rotors in the same plane as the microphone). Test when the conditions are optimal for minimal influence of wind on the noise recording.

(d) Hover condition #2 (sound elevation angle at 45 degrees): The aircraft maintains a hover condition at a lateral distance of 20 feet to the microphone position and at 20 feet AGL. Test when the conditions are optimal for minimal influence of wind on the noise recording.

(e) Hover condition #3 (overhead, or sound elevation angle at 90 degrees): The aircraft maintains a hover condition at 20 feet AGL and hold centered within a one-foot radial over the microphone location.

(f) For the noise measurements at each hover condition, record the value of the equivalent sound level ( $L_{eq}$ ) and sound pressure level in 1/3 octave bands for a minimum of 30 seconds for each of the test conditions (paragraphs 16(c) through (e) of this rule).

(g) The tolerance of the hover height or lateral distance is within  $\pm 1$  ft., and the tolerance of the headings is within  $\pm 5$  degrees.



Sketch of supplemental hover test conditions.  $D = 20$  feet.

#### (17) Measurement of aircraft noise received on the ground – General

(Reference: part 36, appendix J, section J36.109(a), as modified): Aircraft noise



measurements made for the purpose of noise certification in accordance with the requirements of this rule must be obtained using:

- (a) The noise evaluation metric prescribed in paragraph (18) of this rule;
- (b) Acoustic equipment that meets the specifications prescribed in paragraphs (19) and (20) of this rule; and
- (c) The calibration and measurement procedures prescribed in paragraphs (21) and (22) of this rule.

**(18) Measurement of aircraft noise received on the ground – Noise unit**

**definition** (Reference part 36, appendix J, section J36.109(b), as modified):

(a) The sound exposure level, as expressed in  $L_{AE}$ , is defined as the level, in decibels, of the time integral of squared ‘A’-weighted sound pressure ( $P_A$ ) over a given time period or event, with reference to the square of the standard reference sound pressure ( $P_0$ ) of 20 micropascals and a reference duration of one second.

(b) The sound exposure level in units of decibels (dB) is defined by the expression:

$$L_{AE} = 10 \log_{10} \frac{1}{T_0} \int_{t_1}^{t_2} \left( \frac{P_A(t)}{P_0} \right)^2 dt \text{ (dB)}$$

Where  $T_0$  is the reference integration time of one second and  $(t_2 - t_1)$  is the integration time interval.

(c) The integral equation of paragraph (18)(b) can also be expressed as:

$$L_{AE} = 10 \log_{10} \frac{1}{T_0} \int_{t_1}^{t_2} 10^{0.1 L_A(t)} dt \text{ (dB)}$$

Where  $L_A(t)$  is the time varying A-weighted sound level.

(d) The integration time  $(t_2 - t_1)$  in practice must not be less than the time interval during which  $L_A(t)$  first rises to within 10 dB(A) of its maximum value ( $L_{Amax}$ ) and last falls below 10 dB(A) of its maximum value.

**(19) Measurement of Aircraft Noise Received on the Ground – Measurement System** (Reference part 36, appendix J, section J36.109(c), as modified):

(a) Acoustical measurement system instrumentation must be equivalent to the following and approved by the FAA:

- i. A microphone system with frequency response that is compatible with the measurement and analysis system accuracy prescribed in paragraph (20) of this rule;
- ii. Tripods or similar microphone mountings that minimize interference with the sound energy being measured; and
- iii. Recording and reproducing equipment with characteristics, frequency response, and dynamic range that are compatible with the response and accuracy requirements of paragraph (20) of this rule.

(b) The calibration and checking of measurement systems must be accomplished in accordance with the procedures described in part 36, appendix A, section A36.3.9.

**(20) Measurement of Aircraft Noise Received on the Ground – Sensing, recording, and reproducing equipment** (Reference part 36, appendix J, section J36.109(d), as modified):

(a) The sound pressure time-history (audio) signals obtained from aircraft flyovers under this paragraph must be recorded digitally at a minimum sample rate of 44 kilohertz (kHz) for a minimum bandwidth of 20 hertz (Hz) to 20 kHz, and encoded using a minimum of 16-bit linear pulse code modulation (or equivalent) during analog to digital conversion. Digital audio recording must also meet the additional requirements specified in part 36, appendix A, section A36.3.6 “Recording and Reproducing Systems.”

(b) The  $L_{AE}$  value from each flyover and A-weighted  $L_{eq}$  ( $L_{Aeq}$ ) values from each hover test flight condition may be determined directly from an integrating sound level meter that meets the specifications of International Electrotechnical Commission (IEC) Standard 61672-1 (2013) for a Class 1 instrument set at “slow” response.

(c) The acoustic signal from the aircraft, along with the calibration signals specified in paragraph (21) and the background noise signal required by paragraph (22) of this rule, must be recorded in a digital audio format as specified in paragraph (20)(a) of this rule for subsequent analysis for an integrating sound level meter identified in paragraph (20)(b) of this rule. The record/playback system must conform to the requirements prescribed in part 36, appendix A, section A36.3.6 “Recording and Reproducing Systems.” The recorder must comply with the specifications of IEC standard 61265 2nd edition (2018).

(d) The characteristics of the complete system must meet the specifications of IEC standard 61672-1 for the microphone, amplifier, and indicating instrument characteristics.

(e) The response of the complete system to a plane, progressive wave of constant amplitude must lie within the tolerance limits specified for Class 1 instruments in IEC standard 61672-1 for weighting curve “A” over the frequency range of 45 Hz to 20 kHz.

(f) A windscreen must be used with the microphone during each measurement of the aircraft flyover noise. Correction for any insertion loss produced by the windscreen, as a function of the frequency of the acoustic calibration required by paragraph (21) of this rule, must be applied to the measured data, and each correction applied must be included in the test report.

**(21) Measurement of Aircraft Noise Received on the Ground – Calibrations**

(Reference part 36, appendix J, section J36.109(e), as modified):

(a) For the aircraft acoustic signal recorded for subsequent analysis, the measuring system and components of the recording system must be calibrated as prescribed in Title 14 CFR, part 36, appendix A.

(b) If the aircraft acoustic signal is measured directly using an integrating sound level meter:

- i. The overall sensitivity of the measuring system must be checked before and after the series of flyover tests and at intervals (not exceeding a two-hour duration) during the flyover tests using an acoustic calibrator generating a sinusoidal signal at a known sound pressure level and at a known frequency.
- ii. The performance of equipment in the system is considered satisfactory if, during each day's testing, the variation in the measured value for the acoustic calibrator does not exceed 0.5 dB. The  $L_{AE}$  data collected during the flyover tests must be adjusted to account for any variation in the calibration value.
- iii. A performance calibration analysis of each piece of calibration equipment, including acoustic calibrators, reference microphones, and voltage insertion devices, must have been made during the six calendar months preceding the beginning of the aircraft flyover series. Each calibration must be traceable to the National Institute of Standards and Technology.

**(22) Measurement of Aircraft Noise Received on the Ground – Noise measurement procedures** (Reference part 36, appendix J, section J36.109(f), as modified):

- (a) The microphone must be of a pressure-sensitive capacitive type designed for nearly uniform grazing incidence response. The microphone must be mounted with the center of the sensing element 4 feet (1.2 meters) above the local ground surface and must be oriented for grazing incidence such that the sensing element (diaphragm) is substantially in the plane defined by the nominal flight path of the aircraft and the noise measurement station. A microphone that satisfies the requirements of this paragraph must be used when determining compliance with the noise limit prescribed in paragraph (29) of this rule.

(b) For each aircraft acoustic signal recorded for subsequent analysis, the frequency response of the electrical system must be determined at a level within 10 dB of the full-scale reading used during the test.

(c) The background noise, including both ambient acoustical sound present at the microphone site and electrical noise of the measurement systems, must be determined in the test area and the system gain set at levels which will be used for aircraft noise measurements. If aircraft sound levels do not exceed the background sound levels by at least 15 dB(A), flyovers at an FAA-approved lower height may be used; the results must be adjusted to the reference measurement point by an FAA-approved method.

(d) When an integrating sound level meter is used to measure the aircraft noise, the instrument operator must monitor the continuous A-weighted (slow response) noise levels throughout each flyover to ensure that the A-weighted sound exposure level ( $L_{AE}$ ) integration process includes, at minimum, all of the noise signal between the  $L_{Amax}$  and the 10 dB down points in the flyover time history. The instrument operator must note the actual dB(A) levels at the start and stop of the  $L_{AE}$  integration interval and document these levels along with the value of  $L_{Amax}$  and the integration interval (in seconds) for inclusion in the noise data submitted as part of the reporting requirements in paragraph (23) of this rule.

**(23) Data Reporting – General** (Reference part 36, appendix J, section J36.111(a), as modified): Data representing physical measurements, and corrections to that measured data, including corrections to measurements for equipment response deviations, must be recorded in permanent form and appended to the test reports required by this rule. Each correction is subject to FAA approval.

**(24) Data Submission** (Reference part 36, appendix J, section J36.111(b), as modified): After the completion of all certification tests required by this rule, the following must be submitted to the FAA:

- (a) A test report containing the following:
  - (i) Measured and corrected sound levels obtained with equipment conforming to the standards prescribed in paragraphs (17) through (22) of this rule;
  - (ii) A description of the equipment and systems used for measurement and analysis of all acoustic, aircraft performance and flight path, and meteorological data;
  - (iii) The atmospheric environmental data required to demonstrate compliance with this rule, as measured throughout the test period;
  - (iv) Conditions of local topography, nearby ground cover (if any), or events that may have interfered with a sound recording;
  - (v) The following aircraft information:
    - A) Type, model, and serial numbers, if any, of aircraft, engine(s) and rotor(s) and/or propellers tested;
    - B) Gross dimensions of aircraft, location of engines or motors, rotors or propellers, number of blades for each rotor or propeller, and the range of rotational speeds of the rotors;
    - C) MTOW at which certification under this rule is requested;
    - D) Aircraft configuration, including landing gear positions;
    - E) Aircraft Airspeeds:  $V_{NE}$  and  $V_{max}$  for both empty weight and maximum payload configuration, or for maximum range, whichever is greatest, and applicable as reference and operational airspeeds;
    - F) Aircraft gross weight for each test run;
    - G) Indicated and true airspeed for each test run; if indicated and true airspeed for each run are not available, then ground speed as measured from a DGPS, or from an alternate method, may be approved by the FAA;
    - H) Ground speed, if measured, for each run;

I) Aircraft engine performance as determined from aircraft instruments and manufacturer's data; and

J) Aircraft flight path above ground level, referenced to the microphone position of the noise measurement station, in feet, determined using an FAA-approved method that is independent of normal flight instrumentation, such as DGPS or photo scaling techniques at the microphone location;

(vi) Aircraft position and performance data necessary to make the adjustments prescribed in paragraph (27) of this rule and to demonstrate compliance with the performance and position restrictions prescribed in paragraphs (11) through (16) of this rule; and

(vii) The aircraft position in three dimensions and orientation (for hover) relative to the microphone must be monitored and recorded at all times during the test and data collection, with correlation via time synchronization to the acoustic noise data collection.

(b) All of the recorded audio data from all phases of all flight tests used to demonstrate compliance with this rule.

(c) All recordings and data collected during the measurement activity required by paragraph (16) of this rule. These data will not affect the outcome of this certification findings intended to demonstrate compliance with this rule and may be submitted separately from data that affects certification.

**(25) Noise Evaluation and Calculations – Noise Evaluation Expressed in  $L_{AE}$**

(Reference: part 36, appendix J, section J36.201, as modified): The noise evaluation measure must be expressed as the  $L_{AE}$  in units of dB(A) as prescribed in paragraph (18) of this rule. The  $L_{AE}$  value for each flyover may be determined directly using an integrating sound level meter. Specifications for the integrating sound level meter and requirements governing the use of such instrumentation are prescribed in paragraphs (17) through (22) of this rule.

## **(26) Noise Evaluation and Calculations – Calculation of Noise Levels**

(Reference part 36, appendix J, section J36.203, as modified):

(a) To demonstrate compliance with the noise level limits specified in paragraph (29) of this rule, the  $L_{AE}$  noise levels from each valid flyover, corrected as necessary to reference conditions in accordance with paragraph (27) of this rule, must be arithmetically averaged to obtain a single  $L_{AE}$  dB(A) mean value for each flyover series. No individual flyover run may be omitted from the averaging process, unless approved by the FAA.

(b) The minimum sample size acceptable for the aircraft flyover certification measurements is six. The number of samples must be sufficient to establish statistically a 90 percent confidence limit that does not exceed  $\pm 1.5$  dB(A).

(c) All data used and calculations performed under this paragraph, including the calculated 90 percent confidence limits, must be documented and provided in accordance with the data reporting and submission requirements of paragraphs (23) and (24) of this rule.

**(27) Data Correction Procedures** (Reference part 36, appendix J, section J36.205, as modified):

(a) When certification test conditions measured in accordance with paragraphs (7) through (23) of this rule differ from the reference test conditions prescribed in paragraph (6) of this rule, appropriate adjustments must be made to the measured noise data in accordance with the methods set out in paragraphs (27)(b) and (c) of this rule. At minimum, appropriate adjustments in accordance with paragraph (27)(b) of this rule must be made for off-reference altitude and for any difference between reference airspeed and adjusted reference airspeed in accordance with paragraph (27)(c) of this rule.

(b) The adjustment for off-reference altitude may be approximated from:

$$< \delta > J1 = 12.5 \log_{10}(H_T/250) \text{ (dB)}$$



Where  $\Delta J_1$  is the quantity in decibels that must be algebraically added to the measured  $L_{AE}$  noise level to correct for an off-reference flight path,  $H_T$  is the height, in feet, of the test aircraft when directly over the noise measurement point, and the constant (12.5) accounts for the effects on spherical spreading and duration from the off-reference altitude.

(c) The adjustment for the difference between reference airspeed and adjusted reference airspeed is calculated from:

$$\Delta J_3 = 10 \log_{10} \left( \frac{V_{RA}}{V_R} \right) \text{ (dB)};$$

Where  $\Delta J_3$  is the quantity in decibels that must be algebraically added to the measured  $L_{AE}$  noise level to correct for the influence of airspeed on the integration duration of the measured flyover event as received at the noise measurement station;  $V_R$  is the reference airspeed as prescribed in paragraph (6)(c) of this rule, and  $V_{RA}$  is a speed adjustment applied to the reference airspeed to allow flying at an airspeed that provides the reference tip Mach speed. The reference airspeed must be adjusted for the atmospheric conditions on-site.

(d) All data used and calculations performed under this paragraph must be documented and submitted in accordance with paragraphs (22) and (23).

#### **(28) Noise Limit Compliance - Noise Measurement, Evaluation, and**

**Calculation** (Reference part 36, appendix J, section J36.301, as modified): In demonstrating compliance with this rule, the aircraft noise levels must be measured, evaluated, and calculated in accordance with paragraphs (7) through (27) of this rule.

#### **(29) Noise Limit** (Reference part 36, appendix J, section J36.305, as modified):

The calculated noise levels of the aircraft, at the measuring point described in paragraphs (7) through (10) of this rule, must be shown to not exceed 78.0 decibels  $L_{AE}$  at the reference altitude of 250 feet.

**(30) Manuals, Markings, and Placards** (Reference part 36 §§36.1501 and 36.1581, as modified):

(a) All procedures, weights, configurations, and information or data used to obtain the certified noise levels required to demonstrate compliance with this rule, including equivalent procedures used for flight, testing, and analysis, must be approved by the FAA.

(b) Noise levels achieved during type certification must be included in the approved portion of each Unmanned Aircraft Flight Manual for the subject aircraft. If an Unmanned Aircraft Flight Manual is not approved, the procedures and information must be furnished in a combination of manual material, markings, and placards approved by the FAA. The noise level information that must be included is as follows:

i. The noise level information must be one value for flyover as defined and required by these specifications; the value is determined at the maximum reference speed, weight and configuration in accordance with paragraph (6)(c) of this rule. The noise level value must also indicate the series from which it was determined.

ii. If supplemental operational noise level information is included in the approved portion of the Unmanned Aircraft Flight Manual, it must be segregated, identified as information that is provided in addition to the certificated noise levels, and clearly distinguished from the information required by paragraph (30)(b)(i) of this rule.

iii. The following statement must be included in each approved manual near the listed noise level:

No determination has been made by the Federal Aviation Administration that the noise levels of this aircraft are or should be acceptable or unacceptable for operation at, into, or out of any location or environment that may be affected by operational noise.

**(31) Test Plan Preparation and Approval:** Prior to conducting any testing and data collection required by this rule, the applicant must prepare a test plan and obtain

FAA approval of it from the FAA's Aircraft Certification Service, Policy & Innovation Division (P&I) (or another FAA employee designated by the P&I division)

**(32) Test Witnessing:** The FAA P&I Division (or another FAA employee designated by the P&I Division) must witness the test and data collection required by this rule for the results to be valid for certification. Other acoustic focals from FAA's Aircraft Certification Office and Acoustic Engineer(s) from the Office of Environment and Energy or US DOT Volpe National Transportation Systems Center may also be present to observe the tests.

**(33) Test Report Preparation and Approval:** The applicant must prepare a report that includes all of the findings and data required under this rule. The report must be approved by the FAA P&I Division (or another FAA employee designated by the P&I division) as a part of the aircraft certification record.

Issued in Washington, DC, on September 7, 2022.

Augustus Bradley Mims,  
Deputy Administrator.

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